

TITLE: Doppler Lidar Signal and Turbulence Study

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SIGNIFICANT ACCOMPLISHMENTS TO DATE IN FY-83:

Comparison of the second moments of the Doppler lidar signal with aircraft- and tower-measured parameters is being carried out under NASA Contract NAS8-35185 which began in May 1983.

Lidar binary data tapes have been successfully converted to ASCII Code on the VAX 11/780. A trial tape was received from Dan Fitzjarrald for Flight No. 19, July 27, 1981, Central Valley, California. These data were used to develop the computer programs for analyzing data from the MSFC field test. Raw lidar amplitude along the first 50 forward and backward beams of Run No. 2, respectively, have been plotted. Plotting techniques for the same beams except with the amplitude thresholded and range corrected have been developed. Plotting routines for the corresponding lidar width of the first 50 forward and backward beams have also been established. The relationship between raw lidar amplitude and lidar width has been examined. The lidar width is roughly constant for lidar amplitudes less than 120 dB.

A field test with the NASA/MSFC ground-based Doppler lidar, the instrumented NASA B-57B gust gradient aircraft, and the NASA/MSFC eight-tower array was carried out. The data tape for the lidar has been received and read. The aircraft data and tower data are being digitized and converted to engineering units.

Velocities computed sequentially along each of the lidar beams beginning at 16:40:00, May 12, 1983 have been plotted for Run No. 1. For Run No. 1, the lidar was set at 6 deg elevation and 0 deg azimuth angle. The airplane flew approach paths near the lidar beams.

FOCUS OF CURRENT RESEARCH:

Comparison of the lidar second moment results with the B-57B and tower-measured data will be made when these data are available.

Factors which cause spectrum broadening will be analyzed theoretically, thus additional insight into the correlation which may be expected between the lidar second moment and the turbulence parameter measured with other instrumentation will be provided.

PLANS FOR FY-84:

Develop a correlation between turbulence intensities and the Doppler width (second moment) and test the correlation with data gathered during the 1983 experimental field program using the NASA/MSFC ground-based Doppler lidar, the instrumented NASA B-57B gust gradient aircraft, and the NASA/MSFC eight-tower array.

Before developing the correlation with the second moment, it will be necessary to determine the effect of the signal intensity (zeroth moment) on the measurement of the Doppler width by the DLS signal processor.

Analytically investigate the relationship between the turbulent length scale and the second moment of the Doppler lidar signal.